

**Safety Manager Module
Service Manual**
for use with the Triconex TRICON
Version 8 system

SM13-500

**Implementation
Safety Manager TRICON**

***Safety Manager Module
Service Manual***

**for use with the Triconex TRICON
Version 8 system**

**SM13-500
1/97**

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About This Publication

This publication is designed to assist you with the service of the Safety Manager Module for use with Triconex TRICON Version 8 system. Use this manual as a guide for diagnosing faults and troubleshooting your system.

This publication supports **TotalPlant** Solution (TPS) system network Release 500. TPS is the evolution of TDC 3000^X.

All references in this manual to “Safety Manager” or “Safety Manager Module” pertain only for use with the Triconex TRICON Version 8 systems.

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Acronyms

EICM	Enhanced Intelligent Communication Module
HM	History Module
LC	Logic Controller
LCN	Local Control Network
LED	Light Emitting Diode
NCM	Network Communication Module
NIM	Network Interface Module
PLC	Programmable Logic Controller
SM	Safety Manager
SMM	Safety Manager Module
TMR	Triple Modular Redundancy
UCN	Universal Control Network
US	Universal Station

Parameters

UCNPRSFL	UCN primary to secondary failure
UCNSCPFL	UCN secondary to primary failure
NOSYNCH	Secondary not synchronized
UIMBATFL	SMM battery failure
UCNOVRUN	UCN overrun
PPXOVRUN	Point processing overrun
PLCOVRUN	LC overrun
LCLLNOSC	LC not scanning
LCSYSERR	Main processor fault
LCBATTFL	LC battery fault
LCSIOMOL	LC communication or I/O card fault
UIMTSFLT	SMM time synchronization failure
LCTSFLT	LC time synchronization failure

References

For TPS Documentation:

Publication Title	Publication Number	Binder Title	Binder Number
<i>Safety Manager Module Control Functions</i>	SM09-500	Implementation Safety Manager TRICON	TPS 3074
<i>Safety Manager Module Implementation Guidelines</i>	SM11-500	Implementation Safety Manager TRICON	TPS 3074

For TRICON Documentation:

Document Title	Document Number	Binder Title
<i>TRICON Planning & Installation Guide</i>	9720048-001	TRICON Planning and Installation Guide/ User's Manual for Field Terminations
<i>Safety Manager Module User's Guide</i>	97200XX-001	Manuals for Communication Products

Section 1 – SM Hardware and Software Dependencies

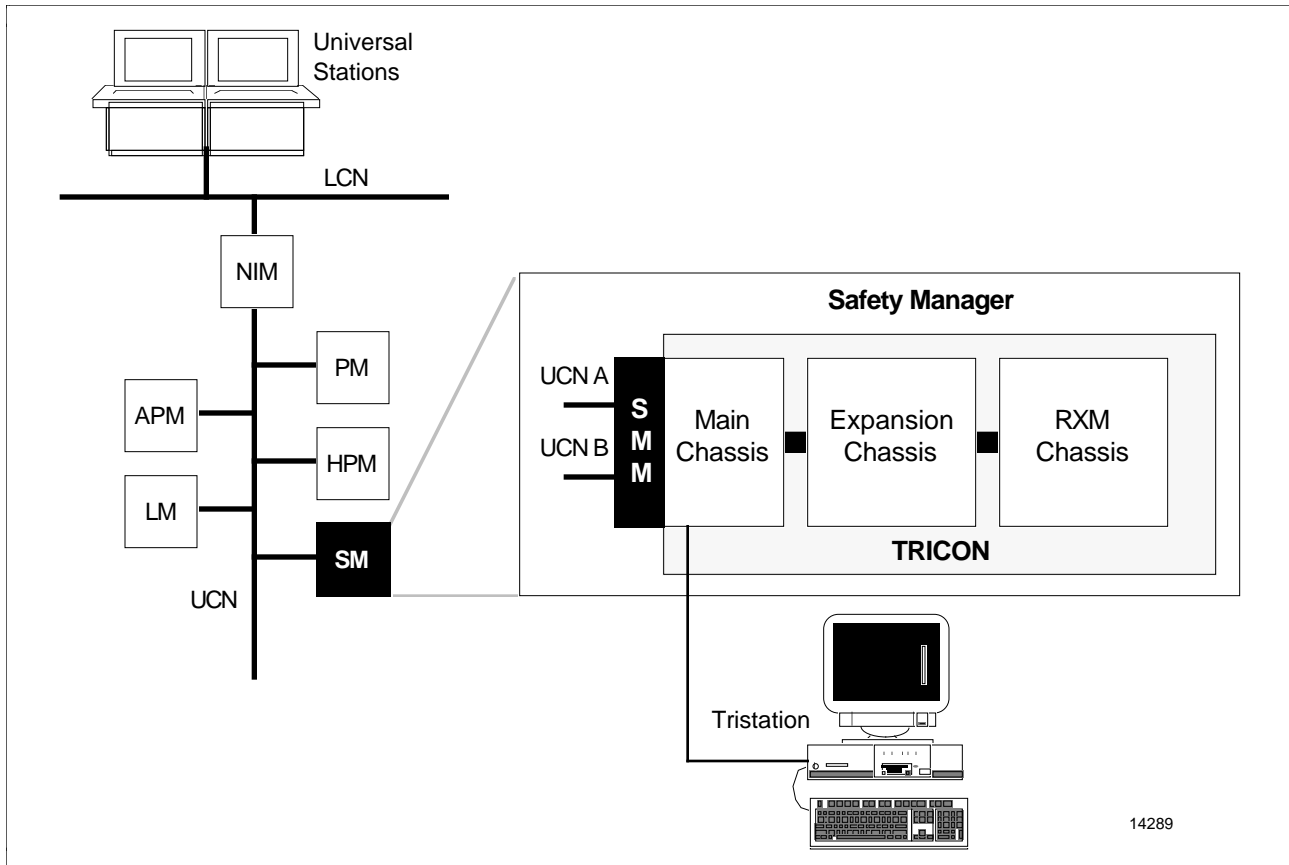
1.1 Overview

About this section This section contains a brief description and functional summary of the Safety Manager (SM), and provides hardware and software requirements and dependencies. The topics included in this section are:

Subsection	Topic	See Page
1.1	Overview.....	1
1.2	Hardware Dependencies.....	6
1.3	Software Dependencies	7
1.4	SM Installation and Configuration Checklist.....	8
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Description As illustrated in Figure 1-1, the SM is a process-connected device that resides on the TotalPlant Solution (TPS) system Universal Control Network (UCN). It consists of a TRICON Programmable Logic Controller (PLC) that includes a Safety Manager Module (SMM).

Figure 1-1 Safety Manager as a Component of the TPS System



Continued on next page

1.1 Overview, Continued

Human interfaces

As shown in Figure 1-1, two human interfaces are used in conjunction with the Safety Manager:

- the Universal Station (US) and the Universal Work Station are two configurations of the TPS level user interface, and
- the TRISTATION which interfaces with the TRICON PLC.

Frontplate features

As illustrated in Figure 1-2, the SMM's frontplate includes the following major features:

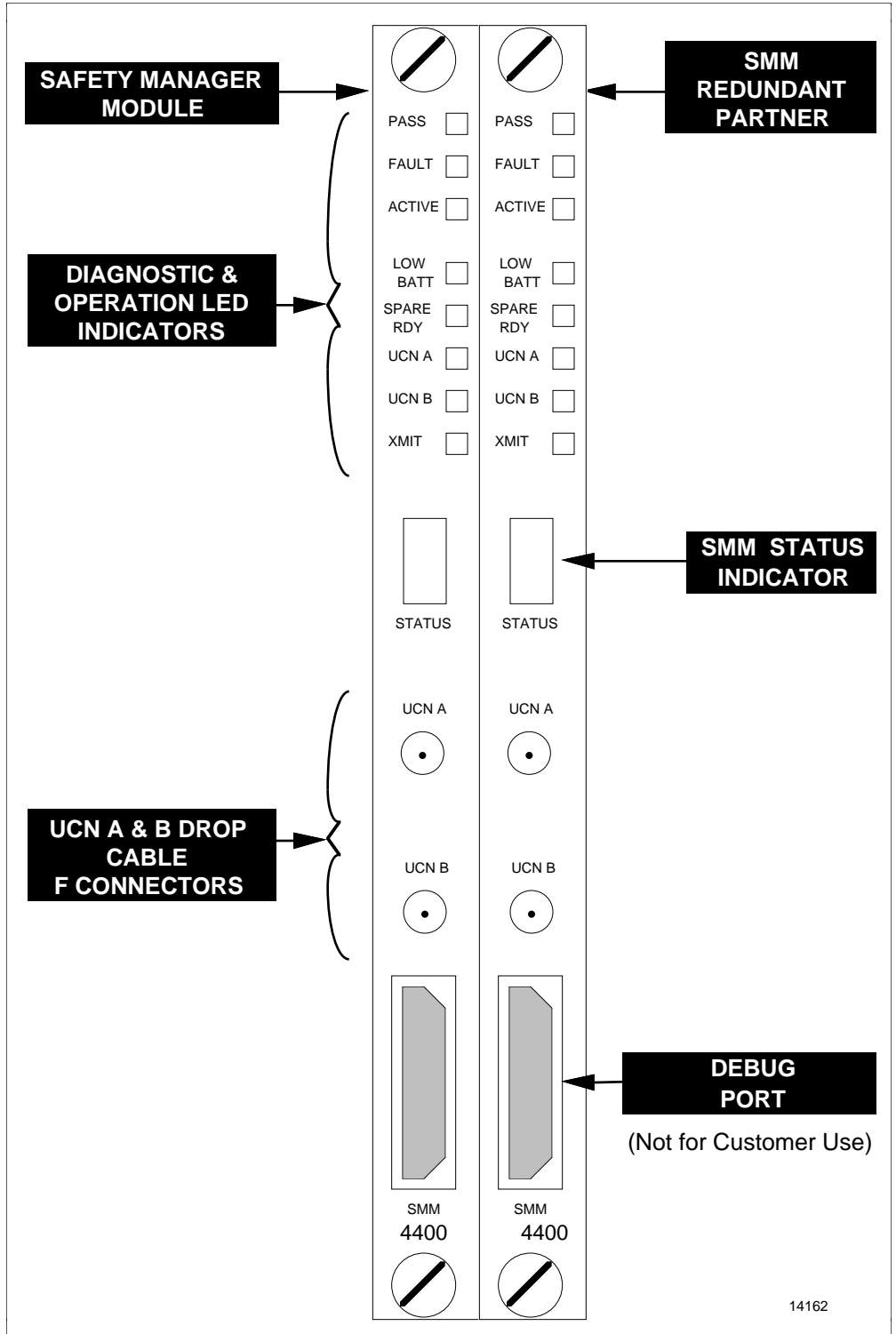
- Diagnostic and operation LED indicators, which indicate the
 - primary UCN redundant status,
 - result of self-test diagnostics,
 - status of redundant (spare) partner,
 - UCN cable that is currently carrying message traffic, and
 - UCN transmit or receive status.
- SMM status indicator (a 4-character alphanumeric display), which shows a code number representing the current operational status of the module or system.
- F-style connectors which provide a link to the redundant Universal Control Network (A and B) via drop cables.
- SMM debug port which provides debug capability to Honeywell personnel only.

Continued on next page

1.1 Overview, Continued

Frontplate features,
Continued

Figure 1-2 Safety Manager Module Frontplate Features



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Continued on next page

1.1 Overview, Continued

Functional summary

The Safety Manager provides a Triple Modular Redundant (TMR) fault-tolerant controller for safety and shutdown application on the UCN. In a TMR system, three separate system legs collect, process, and output process information. A two-out-of-three voting scheme provides a fault-tolerant, high-reliability safety system.

- Each field input signal is
 - collected by an input module,
 - separated into three individual input legs (A, B, C), and
 - placed on individual input/output (I/O) busses.
- Each of the three main processors (A, B, C)
 - receives the input signal over its directly connected I/O bus,
 - votes the input signals with its two main processor companions over a high-speed interprocessor communications link (TRIBUS),
 - processes the input data by executing its resident copy of the control program, and
 - places any resulting output signals back on its individual I/O bus for transmission to the proper output module(s).
- The output module
 - receives output signals from each of the three main processors over individual I/O busses,
 - checks (votes upon) the output signal for consistency with the other two output legs, and
 - transmits the output signal to the connected field device.

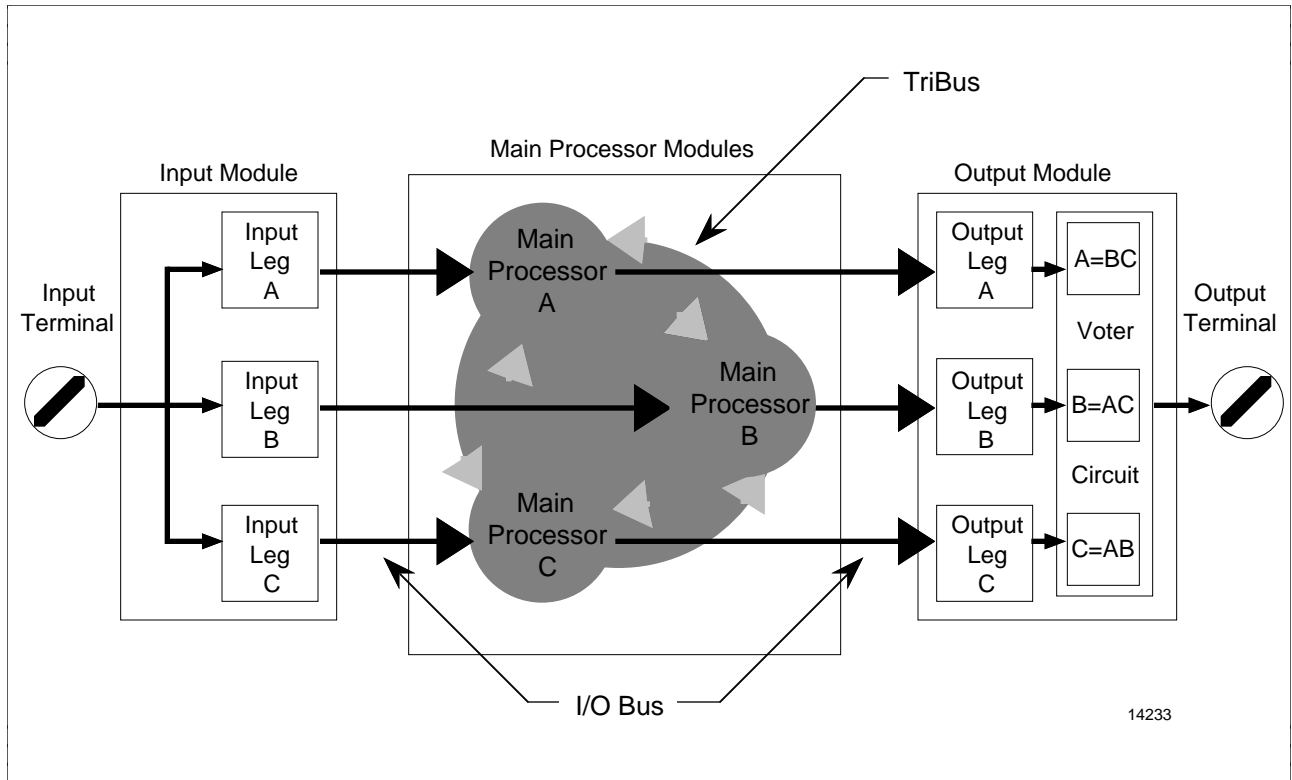
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1.1 Overview, Continued

TMR architecture

Figure 1-3 illustrates the Triple Modular Redundant architecture employed in the Safety Manager.

Figure 1-3 TMR Architecture



ATTENTION

ATTENTION—For detailed information regarding concepts and functions described in this section, refer to SM09-500—*Safety Manager Module Control Functions*, SM11-500—*Safety Manager Module Implementation Guidelines*, and *TRICON Planning and Installation Guide*.

1.2 Hardware Dependencies

Summary

The hardware dependency for the Safety Manager is that the TRISTATION must be a 386/486 personal computer (PC) with

- 8 megabytes (MB) of RAM,
 - 200 MB of hard disk space, and
 - VGA screen.
-

Minimum equipment required

The following list gives the minimum pieces of equipment needed for a Safety Manager system:

- one TRICON chassis,
- one TRICON power supply,
- one TRICON main processor,
- either one Enhanced Intelligent Communication Module (EICM) or one Network Communication Module (NCM),
- one Safety Manager Module (SMM),
- one 386/486 PC with 8 MB, 200 MB, VGA, and Ethernet interface card (if using the NCM),
- one TPS system including a Universal Station (US), a History Module (HM), and a Network Interface Module (NIM), and
- as required, Local Control Network (LCN), Universal Control Network (UCN), and Ethernet cabling.

ATTENTION Refer to subsection 1.4—*SM Installation and Configuration Checklist*.

1.3 Software Dependencies

Summary

The software dependencies for the Safety Manager are

- the Triconex TRICON system must be Version 8 only and
- the TPS control system must be Release 500 or higher.

ATTENTION Refer to subsection 1.4—*SM Installation and Configuration Checklist*.

1.4 SM Installation and Configuration Checklist

Summary

The following checklist is intended to highlight the most critical steps in the installation and configuration of a Safety Manager.

Installation Checklist	
Minimum Equipment Complement	<input type="checkbox"/> 1 each, TRICON chassis <input type="checkbox"/> 1 each, TRICON power supply <input type="checkbox"/> 1 each, TRICON main processor <input type="checkbox"/> 1 each, EICM or NCM <input type="checkbox"/> 1 each, SMM <input type="checkbox"/> 1 each, PC with 486-33, 8 MB, 200 MB, VGA, Ethernet interface card (if using the NCM) <input type="checkbox"/> 1 each, TDC3000x (US, HM, NIM) <input type="checkbox"/> As required, LCN, UCN, and Ethernet cabling
Minimum Requirements	<input type="checkbox"/> Minimum hardware revision levels satisfied. <input type="checkbox"/> Minimum firmware revision levels satisfied. <input type="checkbox"/> Minimum software revision levels satisfied.
TRICON Installation	<input type="checkbox"/> All module backplane connectors inspected prior to installation. <input type="checkbox"/> Chassis grounded to specifications. <input type="checkbox"/> Ethernet address DIP switches configured (on NCM, if used). <input type="checkbox"/> EICM or NCM installed.
SMM Installation	<input type="checkbox"/> SMM chassis key(s) installed in SMM slots. <input type="checkbox"/> All module backplane connectors inspected. <input type="checkbox"/> Module installed and cover screws torqued to specification. <input type="checkbox"/> UCN cables attached and torqued to specification. <input type="checkbox"/> No UNAPPROVED right angle F-connectors used.
TRISTATION Installation	<input type="checkbox"/> Ethernet interface card installed in PC (if NCM used). <input type="checkbox"/> TRISTATION to EICM/NCM cabling installed and on proper ports. <input type="checkbox"/> Up-to-date TRISTATION software installed and operational.

Configuration Checklist	
TRISTATION System Configuration	<input type="checkbox"/> Chassis and non-SMM Module configuration completed. <input type="checkbox"/> NCM's Ethernet address set via LADDER EDITOR, F8 (Program Configuration Screen).
SMM Configuration at TRISTATION	<input type="checkbox"/> SMM Module configuration completed. <ul style="list-style-type: none"> – UCN Address (odd number, 1...63) – Write Protection (on/off) – SOE Number (15/16) – UCN Test Mode disabled – Time Sync (on/off)
Aliases	<input type="checkbox"/> Aliases configured per needs of the SMM. (SMM point configuration depends on existing aliases.) <input type="checkbox"/> SOE Blocks configured. <input type="checkbox"/> Ladder Logic contains SOE collection start commands.
TRICON Configuration Downloaded	<input type="checkbox"/> DOWNLOAD ALL executed. <input type="checkbox"/> TRICON program in RUN mode.

At this point, the SM should be ready for **Node** and **Point Configuration** at the LCN level.

1.5 Specifications

Summary

Refer to Triconex's *TRICON Planning and Installation Guide* for environmental information on

- temperature and humidity,
 - shock and vibration tolerance,
 - protection from atmosphere,
 - conformity to standards and codes, and
 - EMI susceptibility.
-

Section 2 – Spare Parts

2.1 Introduction

Summary

The only Honeywell spare part for the Safety Manager system is the Safety Manager Module. The part number is 51309227-100.

For assistance in ordering this part, cabling, or any other parts, consult your Honeywell representative.

Section 3 – Diagnostics and Troubleshooting

3.1 Overview

About this section This section contains the following topics:

Subsection	Topic	See Page
3.1	Overview.....	13
3.2	Soft Failures.....	14
3.3	Hard Failures.....	18
3.4	Configuration Errors.....	19
3.5	Communication Errors.....	20
3.6	SMM Status Indicators.....	29

Introduction

This section contains information on

- different types of failures,
- configuration and communication errors,
- how to access error information, and
- what actions, if any, to take.

ATTENTION Refer to subsection 1.4—*SM Installation and Configuration Checklist*, to ensure that the SM has been installed and configured properly.

3.2 Soft Failures

Summary

Soft failures are situations where control and process view are maintained, but a fault has jeopardized system integrity.

A Safety Manager softfail will result for numerous reasons.

Softfail descriptions

Table 3-1 lists the types of softfails that may be encountered.

Table 3-1 Softfail Descriptions

Code	Journalled Text	Text Displayed on SMM Diagnostic Displays	SMM Interpretation and/or Comments
19	UCNPRSFL	Pri Cannot Talk to Sec on UCN	SMM has the ability to maintain Database Synchronization over a Private Link and use the UCN as an alternate path for checking the status of their partner.
20	UCNSCPFL	Sec Cannot Talk to Pri on UCN	SMM has the ability to maintain Database Synchronization over a Private Link and use the UCN as an alternate path for checking the status of their partner.
21	NOSYNCH	Secondary Not Synched	Loss of SMM Redundancy.
22	SMTBATFL	SMM Battery Failure	Loss of SMM (UCN interface module) battery. Subsequent loss of SM power will result in loss of SMM database.
34	UCNOVRUN	UCN Overrun	SMM is unable to prefetch data from remote nodes (peer-to-peer inputs).
35	PPXOVRUN	Point Processor Overrun	SMM point scanning is lagging behind schedule.
51	PLCOVRUN	LC Overrun	LC data collection (LC Prefetch) is lagging behind Point Processing or has failed altogether. LC overruns occur if you are operating at or near 500 ms. To correct this, adjust the configuration so that the Logic Controller scan time is less than the SMM scan time.
54	LCLLNOSC	LC Not Scanning	SMM Point Processing requires the Logic Controller to scan its inputs and its user program.
55	LCSYSERR	Main Processor Failure	This is only a soft failure as long as at least one other MP remains operational.
59	LCBATTFL	LC Battery Fault	One or both LC batteries have failed.
63	LCSIOMOL	LC Comm or I/O Card Fault	TRICON System Aliases are signaling an I/O fault between SMM and TRICON.

Continued on next page

3.2 Soft Failures, Continued

Softfail descriptions,
continued

Table 3-1 Softfail Descriptions, Continued

Code	Journalled Text	Text Displayed on SMM Diagnostic Displays	SMM Interpretation and/or Comments
80	SMTSFLT	SMM Time Synch Failure	Set by an SMM upon detection of a UCN Time Sync failure. Causes include: <ul style="list-style-type: none">• UCN Time Sync hardware/software failure.• At least 10 minutes since last UCN Time Sync.
81	LCTSFLT	LC Time Synch Failure	Set by an SMM upon detection of a Logic Controller Time Sync error. Causes include: <ul style="list-style-type: none">• TRICON Time Sync hardware failure.• TRICON Time Sync command processing failure.

Continued on next page

3.2 Soft Failures, Continued

Soft failures US Display Figure 3-1 shows a US Display which provides you with the various Safety Manager soft failures and their corresponding error codes.

ATTENTION All active soft failures will be highlighted.

Figure 3-1 US Display—Soft Failures

		Soft Failures				18 SEP 92 09:18:28 2	
SM Status	19	Pri Cannot Talk to Sec on UCN					
	20	Sec Cannot Talk to Pri on UCN					
VERS/REVIS	21	Secondary Not Synched					
	22	SMM Battery Failure					
SM Config	34	UCN Overrun					
	35	Point Processor Overrun					
UCN STATS	51	LC Overrun					
	54	LC Not Scanning					
MAINT SUPPORT	55	Main Processor Failure					
	59	LC Battery Failure					
SOFT FAILURE	63	LC Comm or I/O Card Fault					
	80	SMM Time Synch Failure					
	81	LC Time Synch Failure					
		UCN AUTO SWAP	ENABLED	KEYSWITCH	RUN	PROGRAM	OCTANE87
		FREE MEM	12345	WR PROTECT	ENABLED	VERSION	7
UCN 001		HOST SOE	ENABLED	SMM RED	REDUNDNT	RQSTD SCN TM	100
NODE 027		NODE STATUS	ALIVE	FILE POS	RIGHT	ACTUAL SCN TM	75
TYPE SM		UCN CHANNEL	A	PRI/SEC	PRIMARY	SURPLUS SCN TM	25
		PLATFORM	TRICON	SYNCHST	NOSYNCH	SCAN OVRNS	0
						POLL TIME	40

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Private link softfail

If the Private Link should fail, it will be treated as a softfail. Because it is a softfail, the two SMMs will maintain a view of the process. Upon Private Link softfail, the SMMs will

- resolve Primary/Secondary status based upon UCN communications or SMM preference, and
- switch to the UCN for Sync and Flush operations.

ATTENTION This is done to maintain redundancy and to allow for the installation of a replacement unit without the loss of the database.

Continued on next page

3.2 Soft Failures, Continued

Keep alive

WatchDog Timer expiration results in a hardware restart. Keep Alive mechanisms will be used for TRICON and Private Link interfaces.

Since the SMM is applied to a TMR architecture, the failure of a link to a TRICON MP will not necessarily dictate a failover. Instead, the SMMs will attempt to isolate the failure and maintain the most effective interface.

Redundant SMMs will channel switchover request through the UCN, Private Link and Comm Bus to provide security against failures in any one or two of those links.

3.3 Hard Failures

Summary

Hard failures result in SMM shutdown (to the FAIL state, ALIVE state, or total reset). Hard failures include

- component failure,
 - program or database failure.
-

Redundant SMM/Time Sync hardware failures

For redundant SMMs, Time Sync hardware failures will trigger consideration of the need for a failover. A failover may not occur if the Secondary is also partially failed (i.e., the SMMs will attempt to keep the most effective SMM as Primary).

ATTENTION Under no circumstances is a non-redundant SMM hard failed for Time Sync problems.

Time sync hardware fault compensation

Total loss of either UCN or TRICON Time Sync functions will result in shutdown of SM Time Sync. Loss at UCN Time Sync is not considered a “total” loss if less than 10 minutes in duration.

Crash codes

Fail (crash) situations involve a large number of possible error codes.

ATTENTION Refer to the “Four-character alphanumeric status display” section in subsection 3.6—*SMM Status Indicators*.

3.4 Configuration Errors

Summary

The SMM configuration must be completed at the TRISTATION and LC aliases must be configured within the TRICON.

To avoid configuration errors, you must

- complete SMM and LC aliases configuration at TRISTATION, then
- download TRICON configuration,

prior to point building at the US. Table 3-2 lists configuration errors for the Safety Manager.

Table 3-2 Configuration Errors

Error	Description
ILLEGAL VALUE	Attempt to write a TRICON hardware addressing parameter (e.g., PLCADDR, LODSTN, CCSRC, !LCxxxx, etc.) which specifies an Alias not available within the host TRICON.
READ ONLY	Response to attempts to write to a read-only SM point.
CONFIGURATION MISMATCH	An invalid LC alias (PLCADDR). Attempt to change PTEXECST to ACTIVE will be denied.

3.5 Communication Errors

US display for communication errors target

Figure 3-2 is the US Display which allows you to access the Communication Error Block screen. To do this, select the “COMMUNCTN ERROR BLK” target.

Figure 3-2 US Display—Communication Errors Target

18 SEP 92 09:18:28 2

COMMUNCTN
ERROR BLK

NODE STS
INFO

SM
Status

CURRENT SMM PROCESSOR FAILURE : NULL
PREVIOUS SMM STATUS : FAIL

VERS/
REVIS

SM
Config

REDUN PARTNER UCN VISIBILITY : VISIBLE
REDUN PARTNER PL VISIBILITY : NOT VISIBLE

UCN
STATS

NODE LOAD FAILURE INFO : 0
LOAD FLAGS : 00

MAINT
SUPPORT

LOAD PACKET NUMBER : 0
UCN NODE PERFORMING LOAD : 0

SOFT
FAILURE

STARTUP/FAILOVER INFO : 0

	UCN AUTO SWAP	ENABLED	KEYSWITCH	RUN	PROGRAM	OCTANE87
	FREE MEM	12345	WR PROTECT	ENABLED	VERSION	8
	HOST SOE	ENABLED	SMM RED	REDUNDNT	RQSTD SCN TM	100
UCN 001	NODE STATUS	ALIVE	FILE POS	RIGHT	ACTUAL SCN TM	75
NODE 027	UCN CHANNEL	A	PRI/SEC	PRIMARY	SURPLUS SCN TM	25
TYPE SM	PLATFORM	TRICON	SYNCHST	NOSYNCH	SCAN OVRNS	0
					POLL TIME	40

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Continued on next page

3.5 Communication Errors, Continued

UCN STATS display,
page 1

Figure 3-3 shows the UCN Statistics display which lists the various UCN communication error statistics, along with other UCN statistics. The values given are samples of what might be expected.

Figure 3-3 US Display—UCN STATS Display, Page 1

LOCAL UCN STATISTICS – PAGE 1				18 SEP 92 09:18:28 2	RESET LOCL STATISTICS	STATISTICS PAGE TWO
SM Status	NO COPY BUFFERS	00005	TOTAL CABLE SWAPS	00016		
	TOKEN ROTATION TIME	11:14	CABLE A SILENCE	00056		
VERS/ REVIS	NO SUCCESSOR FOUND	00000	CABLE B SILENCE	00033		
	ASKED WHO FOLLOWS	00000	CABLE A NOISE	00048		
SM Config	TOKEN PASSES FAILED	00003	CABLE B NOISE	00094		
	NOISE BITS	01001	NO-RESPONSE ERRORS	00001		
UCN STATS	CHECKSUM ERROR	00019	UNEXPECTED RESPONSES	00021		
	REPEATER ERROR	00006	ERRORS IN RESPONSES	00008		
MAINT SUPPORT	PARTIAL FRAME	00000	AUTO-RECONNECTS	00005		
	RECEIVED FRAME TOO LONG	00009	LOCAL MESSAGES	01896		
SOFT FAILURE	NO RECEIVE BUFFERS	00005	MESSAGES SENT	00496		
	RECEIVE OVERRUN	00022	MESSAGES RECEIVED	01400		
	DUPLICATE RWR	00100	MESSAGES DISCARDED	00157		
	NULL RWR (RESYNCH)	00000	REPLY TIMEOUTS	00000		
	TRANSMIT UNDERRUN	00008				
	TRANSMIT FRAME TOO LONG	00029				
	UCN AUTO SWAP	ENABLED	KEYSWITCH	RUN	PROGRAM	OCTANE87
	FREE MEM	12345	WR PROTECT	ENABLED	VERSION	7
UCN 001	HOST SOE	ENABLED	SMM RED	REDUNDNT	RQSTD SCN TM	100
NODE 027	NODE STATUS	ALIVE	FILE POS	RIGHT	ACTUAL SCN TM	75
TYPE SM	UCN CHANNEL	A	PRI/SEC	PRIMARY	SURPLUS SCN TM	25
	PLATFORM	TRICON	SYNCHST	NOSYNCH	SCAN OVRNS	0
					POLL TIME	40

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3.5 Communication Errors, Continued

Local UCN statistics description

Table 3-3 describes each of the local UCN communication error statistics listed in the example US display in Figure 3-3. It also gives a probable cause(s) for why each error might occur.

Table 3-3 Local UCN Statistics

Statistic	Description	Nominal Range Over Specified Time Period; How the System Recovers	Probable Cause
No Copy Buffers	Network Interface Module (NIM) only; no buffers in the processor to copy received messages.	Ideally, should be zero (0). Events are throttled to reduce the probability of errors; the event recovery logic will ensure events are up-to-date.	Increases when the NIM is congested.
Token Rotation Time	NIM only; the average network token rotation in 0.1 millisecond units.	Depends on number of configured nodes that are on the network (e.g., for a six node UCN network, the nominal range is between 4-5 ms). When running smoothly, the user should record the nominal range of his/her system for comparison.	Increases when the node is offnet or the UCN node addresses have gaps. Also increases with more traffic.
No Successor Found	The token ring collapsed.	Should be zero in systems with two or more nodes passing tokens and no communication problems.	Fewer than two token passers, a network communication problem.
Asked Who Follows	A successor node change.	N/A Communication system will automatically look for a new successor.	The shutdown of a node, the powering off of a node, a communication fault.
Token Passes Failed	Token pass to the successor retried.	Should be zero in a smooth network with no faults or nodes entering or leaving.	Communication fault, shutdown, or power down node failover.
Noise Bits	Noise detected.	≤1 count per 10 seconds is typical; the lower, the better. Messages Retried count does not necessarily imply lost messages.	Communication fault, grounding problem.
Checksum Error	Corrupt message, checksum detected.	Should be zero in a smooth system. The message is retried.	Communication fault, marginal modem.
Repeater Error	Corruption in the end delimiter.	Should be zero. The message is retried.	Communication fault, electromagnetic field (EMF) nearby.

Continued on next page

3.5 Communication Errors, Continued

Local UCN statistics description, Continued

Table 3-3 Local UCN Statistics, Continued

Statistic	Description	Nominal Range Over Specified Time Period; How the System Recovers	Probable Cause
Partial Frame	Full message not received.	Should be zero in a smooth system. The message is retried.	Communication fault.
Received Frame Too Long	Message received >1 kB.	Should be zero.	Has not yet occurred.
No Receive Buffers	No buffers for TBC to receive messages.	Should be zero if not overloaded. See recovery procedure for No Copy Buffers.	Overload.
Receive Overrun	Not enough DMA bandwidth for the TBC to copy the received message to memory.	Should be zero.	Hardware problem.
Duplicate RWR	Duplicate message received.	In a smooth system, this may occur about twice a day.	ACK lost.
Null RWR (Resynch)	Used to resynch communications.	N/A	Node startup, failover node failure, communication fault.
Transmit Underrun	Not enough DMA bandwidth for the TBC to transmit.	Should be zero.	Hardware problem.
Transmit Frame Too Long	Inconsistent information given to TBC.	Should be zero.	Software bug.
Total Cable Swaps	The sum of all swaps: operational, automatic, and periodic.	Once every 15 minutes when there are no faults, noise, or silence present.	Periodic cable swap enabled.
Cable A Silence	No energy on Cable A.	Should be zero. The network swaps to Cable B.	Cabling not connected correctly, bad cable.
Cable B Silence	No energy on Cable B.	Should be zero. The network swaps to Cable A.	Cabling not connected correctly, bad cable.

Continued on next page

3.5 Communication Errors, Continued

Local UCN statistics description, Continued

Table 3-3 Local UCN Statistics, Continued

Statistic	Description	Nominal Range Over Specified Time Period; How the System Recovers	Probable Cause
Cable A Noise	Excessive noise on Cable A.	Should be zero. The network swaps to Cable B.	Cabling not connected correctly, bad cable, missing terminator ground.
Cable B Noise	Excessive noise on Cable B.	Should be zero. The network swaps to Cable A.	Cabling not connected correctly, bad cable, missing terminator ground.
No-Response Errors	One or more node did not respond to an RDR.	Should be zero in a smooth system with all nodes on net and properly configured.	Node(s) offnet, node(s) overloaded.
Unexpected Responses	MAC control incorrect in RWR.	Should be zero.	LLC bug or contention (more than one node believes it has the token).
Errors In Responses	LLC part of RWR incorrect.	Should be zero.	LLC bug.
Auto-Reconnect	Network reconnect attempts.	N/A	Network problems.
Local Messages	Intranode local messages.	An increasing number in NIM, zero in SM.	N/A
Messages Sent	Messages sent from node.	N/A	N/A
Messages Received	Messages received by node.	N/A	Reply received after reply timeout, duplicate reply because of lost ACK, bad protocol version, messages from a nonconfigured node (NIM only).
Messages Discarded	Messages ignored.	Should be zero.	Response received after timeout, ACK lost, NIM received a message from a nonconfigured node, protocol version mismatch.
Reply Timeouts	Reply not received in applicable time.	Should be zero.	Overload, failover, power off, shutdown.

Continued on next page

3.5 Communication Errors, Continued

UCN STATS display, page 2

Figure 3-4 shows an example of page 2 of the UCN STATS display. You can access this screen, from page 1 of the UCN STATS display, by selecting the STATISTICS PAGE TWO target.

Figure 3-4 US Display—UCN STATS Display, Page 2

28 OCT 92 09:18:28 2

LOCAL UCN STATISTICS – PAGE 2

RESET LOCL
STATISTICS

STATISTICS
PAGE ONE

SM Status	EVENT SENDER STATISTICS	
	MESSAGES SENT	!!!!!
VERS/ REVIS	MESSAGES RETRIED	!!!!!
	RECEIVER DROPPED	!!!!!
SM Config	NAKS RECEIVED	!!!!!
	THROTTLING REQUESTED	!!!!!
UCN STATS	NUMBER OF EVENT RCVRS	!!!!!
MAINT SUPPORT	TIME SYNCH STATUS	TIME SYNCH STATISTICS
	LCN DATE	28 OCT 1992
	LCN TIME	09:18:28
SOFT FAILURE	SYNCHER MODE	03
	CURRENT STATE	OK
	DRIFT VALUE	7
		SYNCH ERRORS
		00000
		LOST MESSAGES
		00000
		CLOCK ERRORS
		00001
		DRIFT THRESHOLD
		00079
	UCN AUTO SWAP	ENABLED
	KEYSWITCH	RUN
	PROGRAM	OCTANE87
	VERSION	7
	FREE MEM	12345
	WR PROTECT	ENABLED
	RQSTD SCN TM	100
UCN 001	HOST SOE	ENABLED
	SMM RED	REDUNDNT
	ACTUAL SCN TM	75
NODE 027	NODE STATUS	ALIVE
	FILE POS	RIGHT
	SURPLUS SCN TM	25
	UCN CHANNEL	A
	PRI/SEC	PRIMARY
	SCAN OVRNS	0
	PLATFORM	TRICON
	SYNCHST	NOSYNCH
	POLL TIME	40
TYPE SM		

14572

Continued on next page

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Safety Manager Module Service Manual

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3.5 Communication Errors, Continued

Event sender UCN statistics description

Table 3-4 describes each of the event sender UCN communication error statistics listed in the example US display in Figure 3-4. It also gives a probable cause(s) for why each error might occur.

Table 3-4 Event Sender UCN Statistics

Statistic	Description	Nominal Range Over Specified Time Period; How the System Recovers	Probable Cause
Messages Sent	Event messages sent, not including retry.	N/A if no new event. Heartbeat message sent every 10 seconds.	N/A
Messages Retried	Retries caused by NORESP, NAK, or lost ACK for the event.	N/A	Event overload, communication fault.
Receiver Dropped	The number of times an event receiver did not respond after retry.	Zero in NIM, one in SM if there is a NIM failure.	NIM shutdown, NIM failure, NIM congested.
NAKs Received	Message not accepted by receiver.	Should be zero except under heavy event load.	Heavy event load.
Throttling Requested	The number of times the node was requested to delay before sending the next message.	Should be zero except under heavy event load.	Heavy event load.
Number Of Event Rcvrs	The number of nodes ACKing events; SM, LM, and PM only.	The number of NIMs running on the UCN.	N/A

Continued on next page

3.5 Communication Errors, Continued

Time synch statistics description

Table 3-5 describes each of the time synchronization error statistics listed in the example US display in Figure 3-4. It also gives a probable cause(s) for why each error might occur.

Table 3-5 Time Synch Statistics

Statistic	Description	Nominal Range Over Specified Time Period; How the System Recovers	Probable Cause
Synch Errors	Multiple time synch messages per cycle.	N/A	Syncher contention.
Lost Messages	Time synch message lost, sequence broken.	Increments on Syncher change.	Syncher change, network problem.
Clock Errors	Discrepancy between LCN and EPNI, or between APMM and UCN time.	N/A	LCN clock problem.
Drift Threshold	Same as Clock Errors statistics.	N/A	LCN clock problem, EPNI clock problem, APMM clock problem.

Time synch status description

Table 3-6 describes the time synchronization status portion of the example US display in Figure 3-4.

Table 3-6 Time Synch Status

Statistic	Description
LCN Date	Reflects LCN date within the SMM.
LCN Time	Reflects LCN time within the SMM. The time is accurate to ± 1 second.
Syncher Node	The UCN node number of the syncher node.
Current State	The time synch state of this node. A PNI NIM, or a NIM with time synch disabled, will report "Failed."
Drift Value	The value, in units of 50 microseconds, of the difference between the LCN and UCN clocks. A positive value means that the UCN node clock is running faster than the LCN clock. A negative value means that the LCN clock is faster. In synched nodes, the value is derived from averaging synchs. In the syncher node, this value is the signed averaged difference between the two clocks for the previous two synchs.

Continued on next page

3.5 Communication Errors, Continued

UCN addressing errors An SM UCN Address is configured using the TRISTATION. Range checking within the TRISTATION is assumed (1-63, odd addresses only). The left/right module placement within a given slot determines odd/even shadow addressing. It is therefore impossible for an SMM to operate with an invalid UCN address. However, there is no protection against duplicate use of a UCN address.

3.6 SMM Status Indicators

Summary

The front panel of the SMM includes components that show module status and regulate operations (Figure 1-2). The front panel includes

- eight diagnostic and operation LEDs, and
- a four-digit alphanumeric display that indicates the status of the Safety Manager Module.

Table 3-7 lists the eight status LEDs and their functions.

Table 3-7 Functions of Diagnostic and Operation LED Indicators

Indicator	Color	Function
PASS	Green	Indicates status of module.
ACTIVE	Yellow	
FAULT	Red	
LOW BATT	Yellow	Indicates battery is low.
SPARE RDY	Green	Indicates "hot" spare is inserted and ready.
UCN A	Green	Indicates UCN port A is active.
UCN B	Green	Indicates UCN port B is active.
XMIT	Green	Indicates the SMM is transmitting.

Continued on next page

3.6 SMM Status Indicators, Continued

Module status indicators

Table 3-8 lists conditions that the module status indicators represent and provides a description and recommended action for each condition. Refer to Section 4 for removal and replacement procedures.

CAUTION Do not remove an active module.

Table 3-8 Module Status Indicators

PASS	FAULT	ACTIVE	Description	Recommended Action
On	Off	On	The module is active and operating properly.	No action is required.
On	Off	Off	The module is operational but no active.	No action is required.
			<ul style="list-style-type: none"> The module is the hot spare of an active module. The module has just been installed or the system has just been started up. 	Allow a few minutes for the self-initialization procedure to complete.
Off	On	On	The module is an active module (not a spare).	Install a replacement module.
			<ul style="list-style-type: none"> The module is faulty and must be replaced. 	
Off	On	On	The module is active but it has detected a fault.	Install a replacement module.
Off	Off	Either	The indicators/signal circuitry are malfunctioning.	Install a replacement module.

Battery indicator

Table 3-9 gives a description and recommended action for the SMM's battery indicator. Refer to Section 4 for removal and replacement procedures.

Table 3-9 Battery Indicator

LOW BATT	Description	Recommended Action
On	The battery of the SMM is low and needs to be replaced.	Install a replacement module.
Off	The battery of the SMM has sufficient power to sustain communication between the Safety Manager and the UCN.	No action is required.

Continued on next page

3.6 SMM Status Indicators, Continued

Spare ready indicator

Table 3-10 gives a description and recommended action for the SMM's spare ready indicator. Refer to Section 4 for removal and replacement procedures.

Table 3-10 Spare Ready Indicator

SPARE RDY	Description	Recommended Action
Off	No hot spare module is installed.	Install a hot spare module or no action is required, as applicable.
On	A hot spare module is installed and ready for use.	Do not remove the primary SMM until the SPARE RDY indicator is on.

Port activity indicators

Table 3-11 lists conditions that the port activity indicators represent and provides a description and recommended action for each condition. Refer to Section 4 for removal and replacement procedures.

Table 3-11 Port Activity Indicators

UCN A	UCN B	Description	Recommended Action
On	Off	The UCN A port is active but the UCN B port is not.	No action is required.
Off	On	The UCN B port is active but the UCN A port is not.	No action is required.
Off	Off	Neither port is active. The module is faulty.	Replace the module.

Transmit indicator

Table 3-12 gives a description and recommended action for the SMM's transmit indicator.

Table 3-12 Transmit Indicator

XMIT	Description	Recommended Action
Off	The module is not transmitting any messages to the UCN.	No action is required.
On	The module is actively transmitting messages to the UCN.	No action is required.

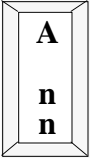
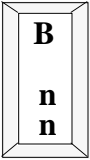
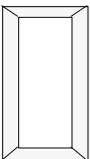
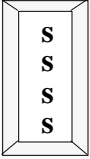
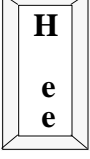
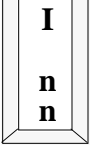
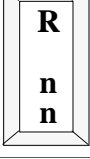
Continued on next page

3.6 SMM Status Indicators, Continued

Four-character alphanumeric status display

Table 3-13 lists conditions that the alphanumeric status display represents and provides a description and recommended action for each condition. Refer to Section 4 for removal and replacement procedures.

Table 3-13 Four-character Alphanumeric Status Display

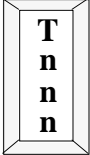
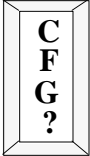
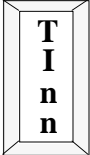

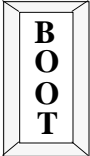
STATUS	Description	Recommended Action
	<p>“A” indicates Alive state and “nn” is the UCN node number.</p> <p>The module is waiting for the Universal Station to download the program and data.</p>	No action is required.
	<p>“B” indicates the Backup state and “nn” is the UCN node number.</p>	No action is required.
	All characters are off at the first stages of start-up and during transition to software operation.	No action is required.
	<p>“ssss” indicates a Software Crash Code. A large number of possible error codes exist.</p> <p>The SMM will be in the Fail state.</p>	Contact the Honeywell Technical Assistance Center (TAC) for help in identifying causes for these failures.
	<p>“H” indicates a hardware fault and “ee” is the error code.</p> <p>The SMM will be in the Fail state.</p>	Contact the Honeywell Technical Assistance Center (TAC) for help in identifying causes for these failures.
	<p>“I” indicates the Idle state and “nn” is the UCN node number.</p> <p>The module is waiting for the Universal Station to give the start-up command.</p>	No action is required.
	<p>“R” indicates the Run state and “nn” is the UCN node number.</p> <p>The module is processing point data normally.</p>	No action is required.

Continued on next page

3.6 SMM Status Indicators, Continued

Four-character alphanumeric status display, Continued

Table 3-13 Four-character Alphanumeric Status Display, Continued

STATUS	Description	Recommended Action
	<p>“T” indicates the Test state and “nnn” indicates the test where the SMM is active or stalled.</p>	<p>No action is required.</p>
	<p>“CFG?” indicates the SMM is waiting for valid module configuration data from the TRICON.</p>	<p>Make sure that the SMM is properly configured at the Tristation.</p>
	<p>“TI” indicates the TRICON Interface Initialization and “nn” indicates the step in progress.</p>	<p>No action is required.</p>
	<p>“IN” indicates Firmware Initialization and “nn” indicates the step in progress.</p>	<p>No action is required.</p>
	<p>“BOOT” indicates that the SMM is booting up its personality (software).</p>	<p>No action is required.</p>

Section 4 – Removal and Replacement

4.1 Overview

About this section

This section provides instructions and references for the removal and replacement of the Safety Manager Module and its components. The topics included in this section are:

Subsection	Topic	See Page
4.1	Overview.....	35
4.2	Replacing an SMM with a Hot Spare	36
4.3	Replacing an SMM without a Hot Spare	37
4.4	Replacing the SMM's Battery	38
4.5	EPROMs.....	39
4.6	SMM Slot Keys.....	40

4.2 Replacing an SMM with a Hot Spare

Procedure

CAUTION Before beginning, make sure that the ACTIVE indicator of the faulty module is off.

When the MP or the SMM detects a fault in the SMM, it turns on the module's FAULT indicator. Follow the procedure in Table 4-1 for replacing a faulty module with a hot spare.

Table 4-1 Replacing an SMM with a Hot Spare Procedure

Step	Action
1	Disconnect the UCN cables from the faulty module.
2	Loosen the retractable fasteners of the module, grasp the fasteners and slide the module straight toward you.
3	Insert a new, identical module into the empty slot. Push the module in until it is firmly seated in the chassis.
4	Connect the UCN cables to the new module.
5	Tighten the retractable fasteners of the replacement module to 10 lb•in (11.3 N•m).
6	The PASS indicator will go on within approximately one minute.

ATTENTION If the above procedure does not correct your problem, verify that the UCN cables are properly connected and in good working order. If the problem persists, contact the Honeywell Technical Assistance Center for help.

4.3 Replacing an SMM without a Hot Spare

Procedure

CAUTION Never remove an ACTIVE module.

When the MP or the SMM detects a fault in the SMM, it turns on the module's FAULT indicator. Follow the procedure in Table 4-2 for replacing a faulty module without a hot spare.

Table 4-2 Replacing an SMM without a Hot Spare Procedure

Step	Action
1	Insert a new, identical module into the empty slot. Push the module in until it is firmly seated in the chassis.
2	Tighten the retractable fasteners of the replacement module to 10 lb•in (11.3 N•m).
3	The PASS indicator will go on within approximately one minute. Make sure the new SMM is in synch with the current SMM.
4	Disconnect the UCN cables from the faulty SMM and connect them to the new SMM. ATTENTION If communication has not already been disrupted by the fault, moving the cables to the new SMM will momentarily disrupt communication between the Safety Manager and the UCN. You may have to initialize the new SMM from the Universal Station before communication can be restored.
5	Loosen the retractable fasteners of the faulty module, grasp the fasteners, and slide the module straight toward you.

ATTENTION If the above procedure does not correct your problem, verify that the UCN cables and TRISTATION cables are properly connected and in good working order. If the problem persists, contact the Honeywell Technical Assistance Center for help.

4.4 Replacing the SMM's Battery

Summary

Each SMM has a battery which maintains configuration data when the Safety Manager is powered off. You should replace the SMM's battery every five years, or after a cumulative total of six months of SM power-off.

You should replace the battery during a scheduled maintenance period when the SM is off-line, or when the availability of SM data is not critical.

ATTENTION Refer to the Triconex *SMM User's Guide* for information on locating and replacing the SMM's battery.

4.5 EPROMs

Summary

EPROMs contain the firmware version currently being used in the Safety Manager system. Each EPROM has a label that provides the following information:

- EPROM type
- Software revision number
- Module serial number

ATTENTION Refer to the Triconex *SMM User's Guide* for information on locating and replacing the SMM's EPROMs.

4.6 SMM Slot Keys

Summary

Each TRICON slot is fitted at the top and bottom with metal keys so that only one type of module fits in a slot.

- If you ordered the Safety Manager Module at the same time you ordered a new TRICON, the keys are correct and no action is required.
- If you ordered the SMM separately, then you have to replace the keys.

ATTENTION For information on replacing slot keys, refer to Triconex's *TRICON Planning and Installation Guide*.

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